MECHANICS.

237. Proposed by C. N. SCHMALL, 604 East 5th Street, New York.

In a naval action an officer observes that in the case of two guns firing, at elevations α and β, respectively, the projectiles of the former fall a feet short of the target while those of the latter land b feet beyond. The initial velocity being the same in both cases, prove that the *true* elevation is

$$\tfrac{1}{2}\sin^{-1}\left[\frac{a\sin 2\beta+b\sin 2\alpha}{a+b}\right].$$

(Suggested by problem 29, page 219, Jeans' *Theoretical Mechanics.*)

Solution by PROFESSOR F. L. GRIFFIN, Williams College.

Let R=horizontal distance to target, V=initial velocity, g=the gravitational constant, and ϕ=elevation of gun to make the range equal to R.

Then the standard formula for the horizontal range gives for the elevations of ϕ, α, and β:

$$\begin{aligned}
&(1)\quad V\sin 2\phi=gR,\\
&(2)\quad V\sin 2\alpha=g(R-a),\\
&(3)\quad V\sin 2\beta=g(R+b).
\end{aligned}$$

Multiplying (3) by a, (2) by b, and adding, we obtain

$$V(a\sin 2\beta+b\sin 2\alpha)=gR(a+b)=V\sin 2\phi(a+b),$$

whence $\phi=\frac{1}{2}\sin^{-1}\left[\dfrac{a\sin 2\beta+b\sin 2\alpha}{a+b}\right]$.

Also solved by H. C. Feemster, J. Scheffer, G. B. M. Zeer, S. G. Barton, and J. E. Sanders.

238. Proposed by G. B. M. ZERR, A. M., Ph. D., Philadelphia, Pa.

Find the position of the center of pressure of a semi-elliptical area completely immersed in water, the bounding major-axis being inclined to the horizon at an angle β, and having one extremity in the surface of the water.

Solution by the PROPOSER.

If the area is not in the same vertical plane as the major axis, suppose it is inclined at an angle α. The ellipse projects into an ellipse in a vertical plane having the semi-axes a and $b\cos\alpha$.

Then from 229, pp, 189-190, Vol. XVI, No. 11, we get

$$=\frac{a(16b\cos\alpha\cos\beta+15a\pi\sin\beta)}{4(4b\cos\alpha\cos\beta+3\pi a\sin\beta)},$$